Identifying and Mitigating Risks in Hydrogen Energy for Safer Integration

Introduction

As society moves toward using hydrogen as a major energy source, it opens up opportunities to rethink our approaches to safety, security, and risk management. Traditional safety studies on hydrogen have been limited, focusing on specific uses and conducting small-scale experiments, with the assumption that hydrogen's use will grow significantly. This aspect might not fully cover the complex challenges and uncertainties of switching to hydrogen energy.

The concept of Strength of Knowledge (SoK) is crucial in this shift. SoK emphasizes the importance of deeply understanding the risks involved, beyond simple predictions from past data or small tests. It's about exploring unknowns to make our risk assessments as accurate and trustworthy as possible.

To address these challenges effectively, we need to combine knowledge from different fields and conduct larger experiments that better reflect real-world conditions. Also, developing and testing the SoK within a broader systems framework will help improve the precision of our safety, security, and risk evaluations as we adopt hydrogen energy.

Primary objective

- Develop novel frameworks for assessing and improving the SoK in risk assessments for hydrogen-based energy systems.

Secondary objectives

- Identifying gaps in understanding and assessing risks, and employing a reliable framework to address these issues
- To create a new model, methods, or structured approaches that are innovative and different from the current methods industries use to assess risk today

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Related projects: *HyValue* WP4*: Hyvalue Centre for Environment-friendly Energy Research (FME)*

PhD-candidate in Risk Management and Societal Safety

Education

- *Master (MSc) in Risk and Safety Management*
- *Bachelor of Science in Statistics*

Experience

- *Data analysis ● Modeling ● Financial management ● Risk analysis*

Estimated progress of the PhD project:

Just started ... | < 50 % | > 50 % | Almost done

PhD Supervisors: Jon Tømmerås Selvik, Eirik Bjorheim Abrrahamsen, & Ove Njå

Publications

Bhandari et al.,(2024).Unavailability Calculation For North Sea Energy Hub Using Fault Tree Analysis and Monte Carlo Simulation Proceedings of the 32nd European Safety and Reliability Conference (ESREL2024).

Bhandari, D., & Selvik, J. T.(2025). On the Use of Fault Tree Analysis to Capturing Dynamic and Multistate Aspects in the Analysis of Hydrogen Systems (In press)

Bhandari et al.,(2025). On the use of the precautionary principle in the context of the hydrogen systems (In press)

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WP4: Safety science and risk

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